THE NEW YORK PUBLIC LIBRARY

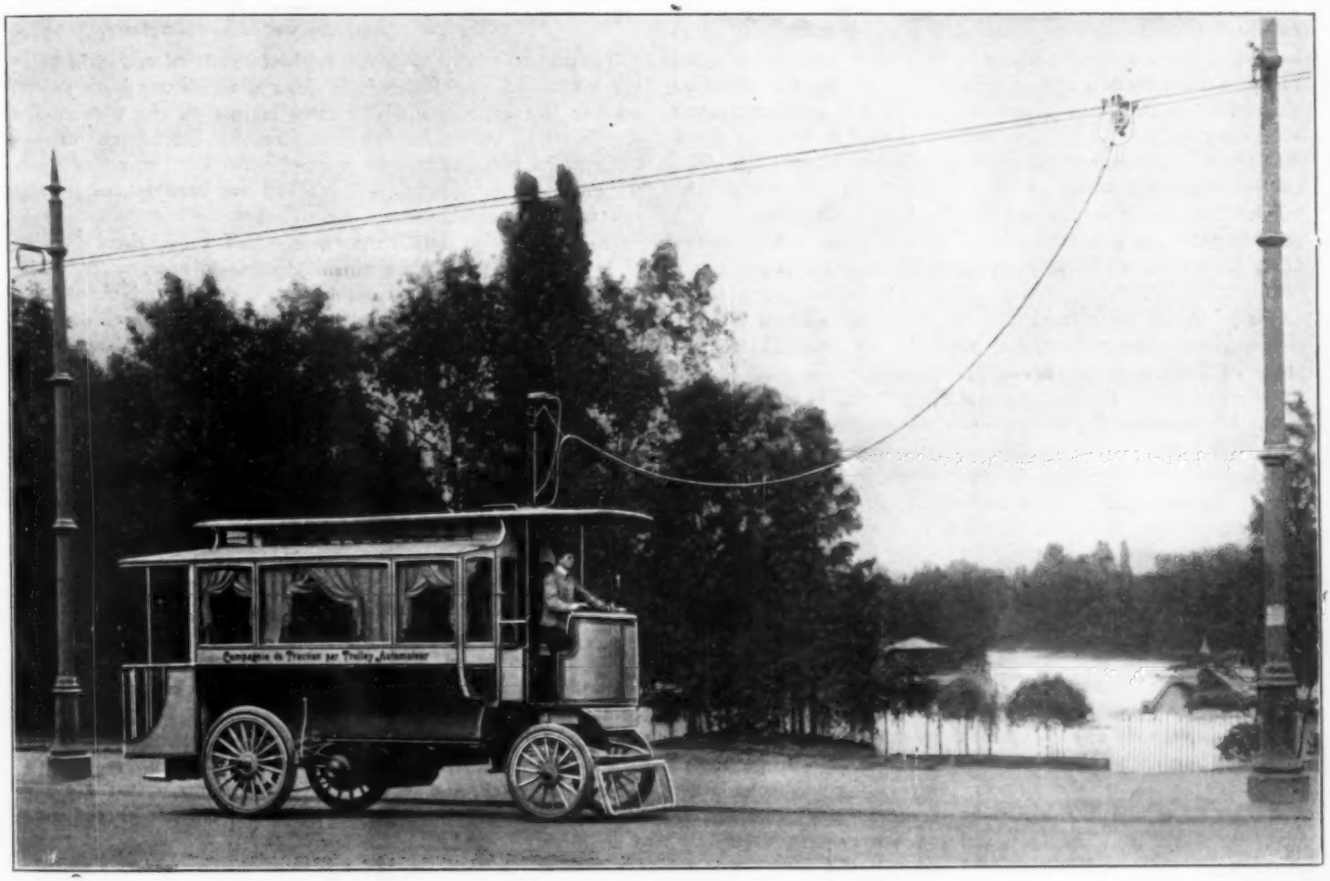
POPULAR MECHANICS

An Illustrated Weekly Review of the Mechanical Press of the World

"Tells you how to do things." Written so you can understand it

Vol. 2. No. 8. CHICAGO, AUGUST 23, 1902. PRICE 5 CENTS.

The Trackless Trolley Car Has Come



Trackless Trolley Car Now Running in France

IN THIS ISSUE:

Highest Bridge in the United States.
Largest Tree in the World Found.
King Edward not an Englishman.
Cloth from Pine Apple Leaves.
Electric Cow Puncher.
Fence Which Will Not Burn.
Railroad Observation Car.
To Burn Fuel Oil Without Pump.
Americans the Greatest Inventors.
Novel Method of Washing Asphalt Streets.
Concrete Tanks for Paper Mills.
Summer Course in Easy Mechanics for Boys:—Building a Canvas Canoe.
Alcohol Fire Engine.
Shop Notes:—Facing Off a Large Wheel—1200 Horse Power Gas Engine—Soldering Aluminum—Water Attachment for Power Drills—Simple Method of Lining an Engine—Antidote for Ammonia Fumes—Colorless Varnish—How to Make Metal Polishes.
The Trackless Trolley Car.
America Helpless in Case of Attack.
Most Isolated Town on Earth.
Wonderful Progress of the Steel Rail Mill.
Electrical Experiments:—Chap. XXXI. The Measurement of Resistance (Concluded.)

Popular Mechanics can be bought of any newsdealer in the United States

THE TRACKLESS TROLLEY CAR.

A System By Which Trolley Cars Can Run On Country Highways—Already a Success in Europe.

The front page illustration shows the latest thing in trolley cars; and this one requires no rails or expensive tracks. Any good country road will do, and as the good roads' movement progresses in this country we may see thousands of miles of these lines reaching into all the rural districts. Mail, passengers, freight, and all kinds of farm produce can be handled, and while the trackless car may not run at 60 miles an hour, it can easily cover 15 or 20 miles in that length of time.

The first essential is a good, smooth road. The better the road the faster the cars can run, and the heavier the loads carried. The conveyance looks like a fine omnibus, and is propelled by an electric motor like our present trolley cars. Two overhead wires leading from the power house extend the entire length of the route. On these wires runs a trolley connected to the vehicle by wires long enough to permit of running on either side of the road. The electric power is conducted from the power house on the overhead wires and from them down into the motor through the wires attached to the trolley. The trolley contains a small motor which propels it along on the wires. The motor in the car may be built as large as desired according to the grades, loads to be carried, speed, etc. On fairly level roads 15 horse-power is sufficient for a 12-passenger car.

One of these lines is already in operation near Berlin, in Germany. One near Paris, last year, earned $23,415, at an expense of $16,111, showing a clear profit on 12 cars of $7,304. Another of these lines is now building from Nice to Upper Monte Carlo, where the route is over the famous Corniche road, built by Napoleon I. Our illustration is from the Street Railway Journal. The cost of the overhead wires is about $2,000 a mile; the cars cost $2,000 each, and are operated in the same manner as a street car, with the extra work of steering, which is done by the motorman.

TELEPHONE FROM CHICAGO TO NEW ORLEANS.

The Illinois Central telephone line between Chicago and New Orleans has been completed. Officials of that road may now talk over the 'phone with the New Orleans office as long as they please without any charges for overtime, as they are not using the line of another company. This is one of the steps in the installation of the Illinois Central's big telephone system covering all of the important terminals and intermediate points on its lines. The New Orleans line runs in a zig-zag direction by way of Memphis and is 933 miles long. Other lines are already in operation between Chicago and East St. Louis, as far as Dubuque, on the way to Omaha, and Fulton, on the way to Louisville. When completed the system will cover approximately 2,500 miles. It has been reported that the Illinois Central intends to substitute the telephone for the telegraph as a means of dispatching trains.

AMERICA HELPLESS IN CASE OF ATTACK.

Startling Inadequacy of Harbor Fortifications Revealed by Investigating Board.

America is defenseless against an enemy's attack so far as harbor fortifications are concerned, according to statements of members of the board of army officers sent out by Secretary Root to investigate the value of high power coast guns. Important guns are subjected to serious accident, owing to defective mechanism. The accidents, it is claimed, will be likely to happen at night and give occasion to the greatest anxiety that were war declared the mechanism of the coast defenses could not be depended upon to outlast the attack of an enemy or to successfully repel an invading navy. It was discovered also that the drill regulations of the artillery are antique and must be revised. They do not fit the conditions of modern armament and are a hindrance to the efficient operation of guns and carriages and auxiliary mechanism. There would be nothing but disaster attending accidents of this kind. The use of subcaliber tubes in target practice is deemed insufficient for its purpose. Most of the men at the posts visited showed a startling lack of familiarity with the guns, and the officers were lacking in interest in their work.

MOST ISOLATED TOWN ON EARTH.

Sredni Kolynsk, in the Arctic Circle, Shut Out From the World for 30 Years.

By Henry De Windt, the well-known Explorer.

The most isolated and the farthest north of any village in the world is Sredni Kolynsk, in Siberia, which our party visited on our late expedition. The town is just on the edge of the Arctic circle and is four months from St. Petersburg. Something of its isolation may be guessed when I tell you that when we arrived there Sredni Kolynsk had not been visited by any one from the outside world for 30 years.

Think of it! Thirty years, nearly half a life time, shut in with no knowledge of the outside world, no newspapers, nothing. The residents knew nothing of the wars and changes in government affairs that have happened in the past three decades. Rulers and nations have come and gone without their knowledge. The people welcomed us with open arms, for we brought them news. Life with them is simply existence. It is too cold to do anything but try to keep warm. They have no industries, no pursuits, except, of course, that they have to obtain food for themselves.

WONDERFUL PROGRESS OF THE STEEL RAIL MILL.

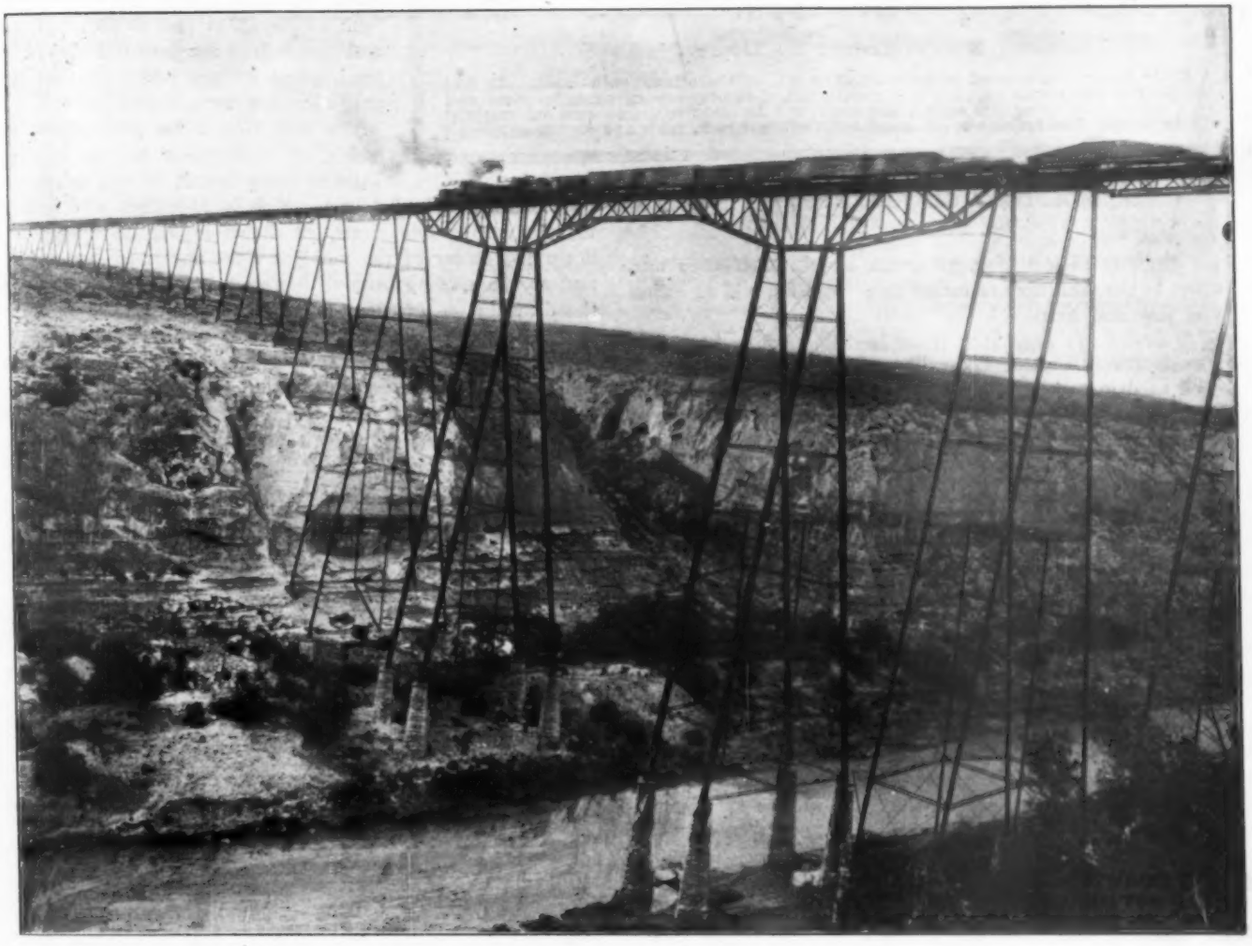
Ingenious Automatic Machinery Has Worked a Commercial Revolution in the System.

The production of 2,700 tons of steel rails in a day by a single modern rail mill, a performance that has been many times repeated recently, calls attention to the modern improved methods of rolling rails in contrast to the old-time methods. This single day's production of one mill is enough to lay more than 21 miles of track, and of all the 8,000 rails made that day the difference between one rail and the others did not exceed 1-64 of an inch.

It used to be that the rail mill was man's nearest approach to the traditional purgatory; a teeming, sizzling hive of white hot metal and sweating humanity. Breathing the fiery air the men tugged, hauled, raised and shoved the molten steel from roll to roll, from pass to pass, entirely by brawn and muscle, aided only by clumsy hooks and tongs. Two hundred tons a day then was considered a good showing.

Automatic machinery has worked the seemingly magic change. At its introduction the cost of making rapidly fell before increased production and decreased labor. At first many men were thrown out of work, but the increased demand that followed was a boon to labor as well as capital. Now the employes get much better salaries than ever before, their work is easier by far and their hours are shorter. Many men in rail mills earn $25 a day. The ingenious mechanical appliances that have added so much to the efficiency of the modern mill includes the driven tunaway, the movable table, the multiplication of rolls, the cambering machine, the mechanical hot bed, and others of almost equal importance. With these inventions one man can now accomplish five times as much as under the old conditions.

Highest Bridge in the United States



This Bridge is 321 Feet High, and 2180 Feet Long

The highest railroad bridge in the United States and the third highest in the world is over the canyon of the Rio Pecos, western Texas. Our illustration is from the Southwest, published monthly at Houston, Texas. The viaduct is 2,180 feet long and 321 feet above the river. The ties on the bridge are all fireproofed and the structure is constructed of steel and masonry. The bridge, which is on the line of the Southern Pacific, is a great sight for travelers.

LARGEST TREE IN THE WORLD FOUND.

Larger than the largest tree ever before discovered is the great tree that has just been found far up in the Sierras south of Fresno, Cal. Six feet from the ground it took a line 154 feet 8 inches long to encircle it, making it more than 51 feet in diameter.

TELEPHONE INVENTOR BUILDS AIRSHIP.

An airship, which some assert will solve the problem of aerial navigation, is being built at Baddeck, Cape Breton, by Alexander Graham Bell, of telephone fame. Many thousand dollars have been spent in the construction and Mr. Bell has exerted every effort to keep the details secret. The machine is 20 feet long and is composed of 75 distinct parts. It is celled internally with canvas and in places with linen stretched on piano wire. Five miles of this wire have been used. The ship is constructed largely on the principles of the kite. This means that the aeroplane system, not used in any of Santos-Dumont's airships, will be a feature of this somewhat mysterious machine. The telephone is pointed to as proof that Prof. Bell will triumph in his present field of science.

DARING OF ALFONSO NEARLY COST HIM HIS LIFE.

The young king of Spain takes a great interest in warships, and there is nothing he likes so much as to witness a drill of the crew of a battleship. This desire nearly cost him his life a few days ago, according to private reports from San Sebastian. Alfonso, bent on adventure, walked to the strand and asked a fisherman to row him to the warship Giraldo. Arriving, Alfonso tried to scale the rope ladder, when the sentinel ordered him to stop at the peril of his life. The fisherman's cries brought the officer on watch, who beheld the king hanging at the ship's side, the sentinel's dagger at his throat. He called off the soldier, whereupon Alfonso boarded the vessel, climbed into the lookout and gave the signal for the alarm gun to be fired. He was highly amused by the spectacle of seeing officers and men, half-dressed, stumbling on deck and going through the various drills.

"In choosing reading matter too much care cannot be bestowed upon the selection of large clear type and upon good paper, and, as almost everything worth reading can be found well printed cheap and injurious publications should be eschewed."—Frank Alport, M. D., in the Chicago Tribune.

Summer Course in Easy Mechanics For Boys.

By Wilbert S. Drew.

[This series, commenced in issue of June 28, will continue each week. It will give instructions which any boy can understand, how to use carpenter's tools and make things. In doing this only a few tools will be required, and cost of material will be small. The articles to be made will include a boat, table and similar subjects.]

BUILDING A CANVAS CANOE.

This canoe is 16 feet long, 31 inches beam at the water line, 29 inches at the deck line, 12 inches deep amidship and 20 inches deep at bow and stern.

Fig. 1 shows the lines at 7 cross sections, 12.8 inches apart and one-fourth full size. These lines must be enlarged to full size and used in making the molds, as will be explained below.

In order to avoid all cut and try work all the lines of the canoe should be laid down full size. We would have to draw the cross sections, the water lines and the diagonals, making our drawings 16 feet long, but as most of our readers probably have neither the equipment nor the necessary training for making such a drawing, other means must be resorted to, and as a first step the lines in Fig. 1 should be drawn full size and made as accurate as possible. In order to do this draw two lines OX, OY, at right angles to each other; then take any point in one of the lines at A, on line 3, and measure carefully its distance from OY and also from OX. Multiply the distances thus found by 4 and lay out the point indicated on the drawing. Now select another point as B, and locate this in the same manner. Proceed thus until a series of points about an inch apart have been located throughout the length of the line and then draw the line smoothly through these points. It will be sufficient if every other line as 1, 3, 5, 7 is drawn.

Now it is very necessary to provide a frame over which to build our canoe, in order to hold the siding in place until the ribs and gunwale are secured in position. For this take two 8-inch boards 1 inch thick and fasten them together by cleats 24 inches long, as shown in Fig. 3. Nine of these cleats are used and are spaced as shown, the distance between their centers being 21 1-3 inches, except in the case of the middle one, which is placed just in the middle of the frame. Ten pairs of legs are next put in place as seen in Fig. 3, and securely nailed both to the frame and to the floor, seeing that the boards are level; if they are not level, place wedges under the low points until they are brought into line.

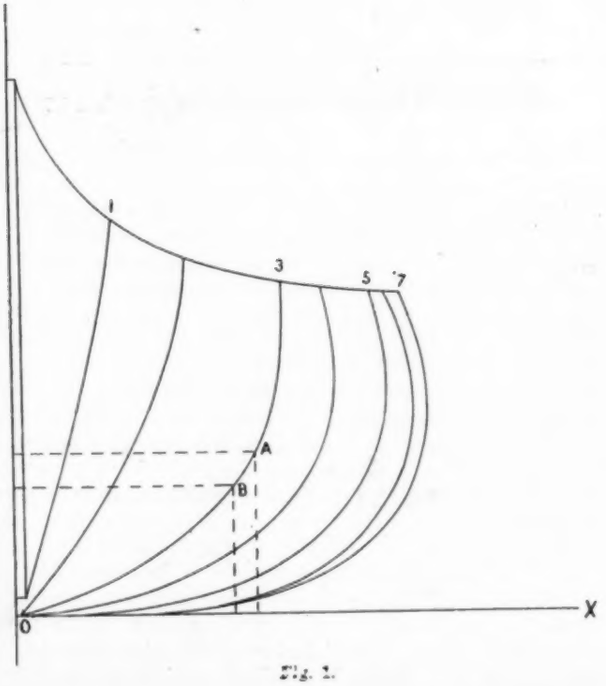


Fig. 1.

The next step is the preparation of the molds, of which there are eight required. Take as many boards as may be necessary to give the required height, which is 20 inches, and nail them together, using two cleats, as shown in Fig. 2. Draw a line down the center of the mold at right angles to the top board and on the side opposite to the cleats. Place the line O Y of the drawing on this center line so that the two lines coincide, and secure the drawing in place with a few small tacks; now take a sharp steel point, such as the end of a fine wire nail, and prick through the drawing into the mold, making the punctures about one-half inch apart. Remove the drawing, being careful not to tear it; turn it over and again place the center line of the drawing on the center line of the mold, secure in place as before, and prick through the holes already made. Now remove the drawing, draw a smooth pencil line through all the points and saw to the lines with a keyhole saw. When the mold is finished it will look like Fig. 2, which is one of the middle molds at No. 7. As there are four pairs of molds, making eight in all, it will be necessary to make two molds of each shape drawn.

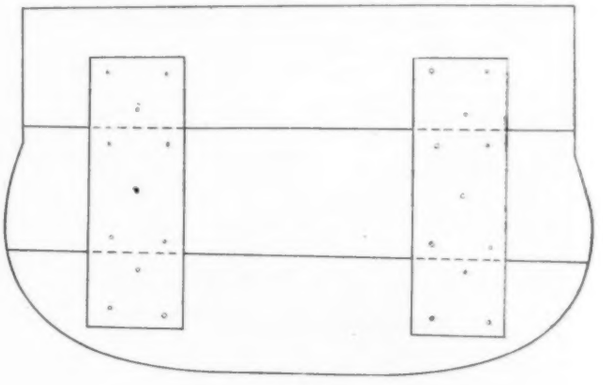


Fig. 2.

Having made all the molds, stretch a chalk line tightly exactly over the center of the frame. A nail may be driven into the wall at each end of the room and the line tied to these. Now nail each mold in its proper position, first locating its center correctly by plumbing down from the line which should be at least two feet above the frame. If you have no plumb bob, a small piece of iron tied to a string will serve the purpose, but the weight must not be too light; it should weigh at least five or six ounces.

The siding, which we are nearly ready to put on, should be either cedar or cypress, one-eighth inch thick; but before putting it on we must fair our boat, as it is called. This should have been done in the drawing, but as we have drawn only the molds of the full size, we must determine whether or not the water lines are fair. Take a strip of the siding, not over 2 inches wide, and lay it on the molds at various places and tack it in place, one tack into each mold, and then sight along the outside of the strip to see if there are any hills and hollows in it; if so, the molds must be slightly cut down or built up in places, as the case requires, until the strip will lie fair at all points, from keel to gunwale. When this has been accomplished our canoe is ready for the siding which, for easy working, should not be more than 3 inches wide.

As the girth of the canoe is much greater in the center than

PUBLIC LIBRARY

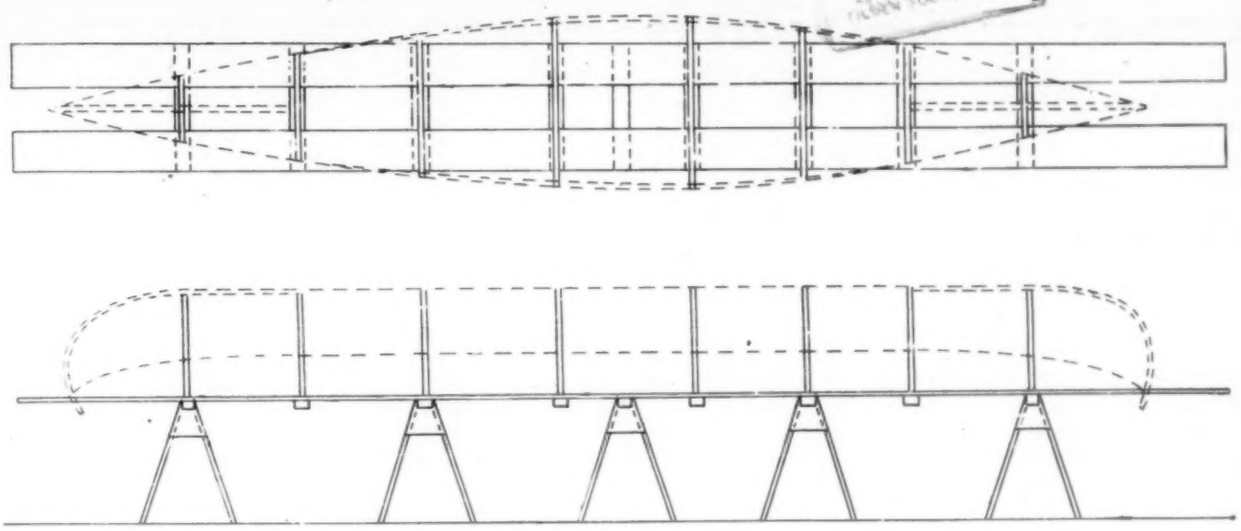


Fig. 3.

at the ends, the streaks must be cut narrower at the ends than in the middle. To get the shape for each streak, divide up the distance from keel to gunwale along each mold into seven or eight equal parts, and mark these spaces in pencil on the molds; then each streak can be held in position, the width at each mold marked on it, these points connected by a line and the piece cut to shape.

One more thing, however, is necessary before fastening the streaks in place. The stem and stern parts must be made and secured in position, and for these two pieces of white oak, ¾ in. x 1 in. x 4 feet long, are required, and they must be bent to the shape shown in Fig. 4, which will appear next week.

As we shall require a steam box for preparing our stem and stern posts, ribs and gunwales, it will be explained now. It is simply a rectangular box, 8 inches square in cross section and about 4½ feet long. The sides are made of inch boards, nailed solidly together and both ends should be hung on hinges. The boiler can be conveniently made of an ordinary two gallon milk can. A hole should be cut in the middle of the bottom board of the box large enough to admit the top of the can loosely. The can is placed on an ordinary cook stove, gas stove, oil or coal stove, filled half-full of water and a good fire built. The box must be provided with suitable legs to hold it in position or it may be swung from overhead by a rope at each end.

The pieces to be bent are placed in the box, the doors closed and steam kept up until the pieces are very pliable. They are then removed, clamped in a mold and left until dry, when they will retain the shape given them.

These directions are much more simple in actual practice than they appear on paper, and will be continued next week.

MORGAN'S LUNCHEON WITH THE EMPEROR.

The fact that J. Pierpont Morgan took luncheon with Emperor William on board the imperial yacht Hohenzollern, recently, is still creating comment in Europe. The Neue Freie Presse, of Vienna, in a satirical editorial, says:

"Without his check book Mr. Morgan would never have been the emperor's guest. Could a thought reader have penetrated the secret recesses of the minds of Emperor William and his guest, what startling contrasts might he not have discovered. In Emperor William's mind, perhaps, a yearning for fame and splendor; in that of Mr. Morgan the hope of new trusts and rising prices. How fortunate it is that social politeness veils such opposites."

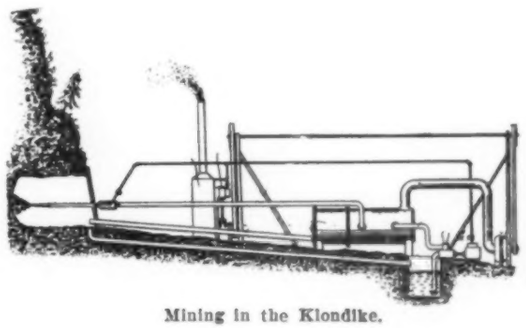
Wireless telegraph plants for the United States Signal corps are to be installed at Fort Wadsworth and Fort Hancock.

KING EDWARD NOT AN ENGLISHMAN.

Of the 4,056 drops of blood which circulate in King Edward's veins, only one is English, namely, the one which comes from Margaret Tudor, wife of James IV of Scotland. The king has two drops of French blood derived from the unfortunate Mary Stuart; five drops of Scotch blood, for which he is indebted to James IV, and to Darnley, Queen Mary's husband; eight drops of Danish blood and 4,040 drops of German blood.

MACHINE TO THAW FROZEN GROUND.

Owing to the very short summer in Alaska, in many mining camps the frost never comes out of the ground more than 10 or 12 feet. In order to accomplish much work various methods are used to thaw the frozen earth. Geo. R. Clarke, of



Mining in the Klondike.

Dawson, Canada, has invented a machine which consists of a boiler for heating water and a pump to force it into the mine. The water runs back through a pipe to be heated and used again. The warm air of the inclosed mining chamber is also drawn through a pipe to furnish a warm draft to the furnace fire.

CLOTH FROM PINEAPPLE LEAVES.

Another substance from which cloth can be made has been discovered. It is the fiber of pineapple leaves. The cloth is said to be far superior to cotton fabrics and bears a close resemblance to silk. George B. Munsing, who has a pinery near Tampa, Fla., is perfecting plans for the establishment of a plant, in that city, for preparing the fiber.

Great Salt lake is drying up. The fall of the water since 1894 amounts to nearly six feet.

Popular Mechanics

Published by Popular Mechanics Co.
Journal Building, - - - Chicago

SUBSCRIPTION

United States, Canada, Mexico and all U. S. Possessions, per year **$2 00**
Foreign Countries, post paid **3 00**
Monthly Edition **1 00**

Long Distance Telephone Main 2682

Popular Mechanics is an illustrated weekly review of the mechanical and engineering press of the world, presented in plain, simple language, and condensed as much as possible. We always credit publications from which illustrations and facts are taken. Where the name only of such publication is given, it indicates we have used practically the entire article. Where name of publication with date of issue is printed, we have made only a brief digest, and those of our readers who desire to study all the details of the subject should procure from its publishers, or their local newsdealer, the copy of that date

Popular Mechanics is mailed in time to reach every part of the country by Saturday morning.

Make Remittances by Draft, Money Order or Registered Letter.
Address,
POPULAR MECHANICS
Journal Building, - - Chicago

Entered at the Chicago Postoffice as Mail Matter of Second Class.

ELECTRIC COW PUNCHER IN KANSAS CITY.

Splendid results have been obtained from an "electric cow puncher," which has recently been put in service in the stock yards at Kansas City. It does away with the laborious duties necessary with the use of the common whip and goad. It frightens the cattle without angering them and leaves no bruise on the beef which would impair its value in the market. The electric puncher is regarded as an absolute safeguard against stampedes. So far it has done away with all back rushes and dragging in with chains. The "puncher" is fitted with brass points which are terminals of a 125-volt circuit. About 20 feet of wire is attached to each stick, giving a considerable radius of operation. Electric shocks have been secretly applied on race tracks for some time, but this is the first time the electric goad has been put into legitimate commercial use.

BROOKLYN BRIDGE OVERCROWDED

Great Span Reported Unsafe. Moving Sidewalk Would Solve the Problem.

The great suspension bridge connecting New York and Brooklyn is reported unsafe by experts who have recently made an examination. In addition to the wagon traffic and the thousands of passengers, the endless string of trolley cars combine to produce a strain far in excess of what was anticipated when the bridge was built. Not only that but the present means of transportation are far from sufficient.

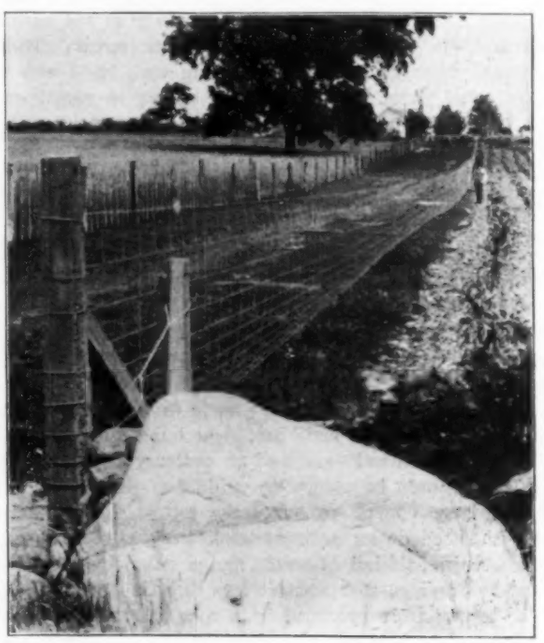
A solution of the problem is suggested in taking off the trolley cars, which weigh on an average 10 tons each, and seat only 18,000 per hour, and installing the moving platform system which would easily handle 70,000 seated passengers per hour. This is the same system that was operated so successfully at the World's Fair in Chicago, where 2,700,000 passengers were carried, and at the Paris Exposition, where 9,000,000 were carried, and no one was ever injured at either place. For the bridge service the platforms would be incased in glass, warmed in winter and seats provided. A proposition is now before the bridge commission to carry passengers for one cent each and pay the city $150,000 a year for the privilege. Engineers of national reputation have recommended the change to the moving platform which is very much lighter and will carry nearly four times as many people as the present trolley cars. The plan is endorsed by Julien T. Davis, Geo. S. Morrison, Walter E. Edmonds, Thos. C. Clark and many others.

Passengers would first step on the slow platform and from that to the faster one, which is provided with seats, and which would take care of 1,173 passengers a minute and carry them 880 feet per minute. The seated and standing load would be 100,000 passengers per hour and constitute the greatest carrying system ever attempted. As the conveyor would be in operation constantly passengers would never have to wait for a car and the great crowds which now gather during the rush hours would be entirely prevented.

There would be four platforms; the first moving at 2½ miles an hour; the second at 5 miles; the third at 7½ miles, and the fastest at 10 miles.

FENCE WHICH WILL NOT BURN OR ROT.

One of the most interesting and unique purposes to which cement has been applied is in using it to make fence posts. The



Cement Post Supporting Forty Rods of Fence.

cement is mixed and poured in a wooden mold to make the post. Ornamental posts are secured by using proper molds. Municipal Engineering illustrates a wire fence in which cement posts are used. So strong are the posts, two of them support a fence 40 rods long as shown in the cut.

Cement End Post for Fence.

PAYS $200 FOR FORTY SQUARE INCHES OF GROUND.

Record of New York Real Estate Broken by Man Who Intends to Make 500 Per Cent on Investment.

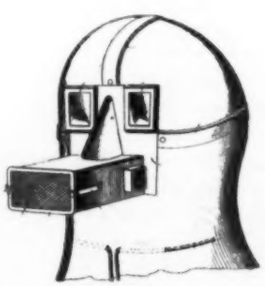
All that remained of the Uhl estate after the city of New York had taken all the land it desired for the widening of 149th street several years ago, was a little triangle of ground containing 40 square inches at 149th street and Grace avenue. For this diminutive lot J. Clarence Davies, a few days ago, paid to Samuel G. Walker $200 or $5 per square inch. It was the highest price, proportionately, ever paid for land in the history of New York. At this rate a square foot of land would be worth $720 and an ordinary city lot of 25 by 10 feet could be bought for $1,800,000.

Mr. Davies intends, however, to get a return of 500 per cent on the little triangle. He says that the stoop-line privilege covers a strip five feet wide on both the avenue and street frontages of his lot, and that this will afford sufficient area for a covered entrance and also for a flight of stairs leading downward. Once below the surface, according to Mr. Davies' ideas, his ownership of the little gore will entitle him to construct vaults under the sidewalk 15 feet further toward the curb on both streets, so that with the five feet of stoop-line privilege and fifteen feet of vault he will have a subterranean chamber about 20 by 20 feet, which he thinks will be readily rentable at, say, $50 per month, or $600 a year.

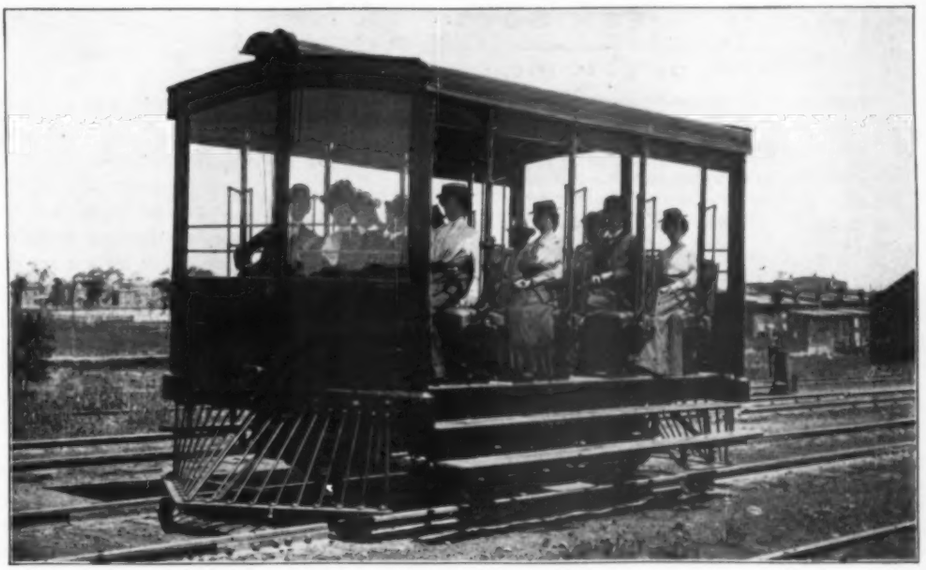
Above ground the advertising sign man will be allowed "to go as far as he likes" for a monthly stipend of $50, making an annual income of $1,200 for the entire enterprise.

A NEW RESPIRATOR.

Our illustration does not show a snow man trying to swallow a cigar box, but represents a respirator, the hood of which is made of a metal helmet and sheet rubber. It has two windows but no ears, making it specially valuable to men troubled with curtain lectures at night. The strainer at this end of the box prevents one from bolting his food, or swallowing large germs. The respirator should become popular with automobile scorchers.



Railroad Observation Car in Canada



Observation Motor Car, Canadian Pacific Railway.

A queer looking motor car is that just put in service by the Canadian Pacific railway for the purpose of giving tourists a better view of the mountainous district about Banff Hot Springs in the heart of the Canadian Rockies. The car is 13 feet 6 inches long over the body and 20 feet long over all. It is opened at the sides and is fitted with cushioned seats running across the car except at the center, where a space is provided for the engineer.

The Railway Review says:

"The car is designed to furnish the traveler with a comfortable and rapid conveyance for touring the Canadian Rockies, and for obtaining a view of the same as close quarters. The ends of the car are closed with large sheets of plate glass and curtains are placed on the sides to serve as a protection from the sun or rain. The seating capacity is 14 persons. The motor power is supplied by 20 horse power gasoline engines and the car can obtain a speed of 30 miles per hour on a level track while having sufficient power to climb any of the mountain grades or haul a trailer.

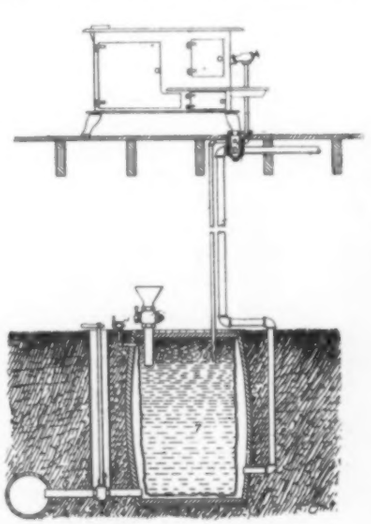
GREAT VALUE.

The Book and News Dealer, New York, an authority with the trade, says: "Popular Mechanics now issues a monthly number, each one holding four of the weekly copies, all bound in a plain cover bearing the tables of contents and retailing for 10 cents.

"These are positively the greatest value ever offered in the way of popular science and scientific and mechanical news, so worded that every one may understand it, and no person be too poor to buy."

TO BURN FUEL OIL WITHOUT PUMP.

Where fuel oil is burned under steam boilers it is sprayed with considerable pressure, either by steam from the boiler itself or by means of a powerful pump. Either of these methods is impractical for domestic purposes. To burn fuel oil in cook stoves, John C. Quinn, of Port Costa, Calif., has invented a system by which the oil is placed in a barrel buried in the ground; water from the city mains or a windmill tank is let into the barrel, thus forcing the oil up into the burners. When all the oil is used the water is shut off, the barrel emptied into the sewer, and then refilled with oil.



Burning Oil in Cook Stove.

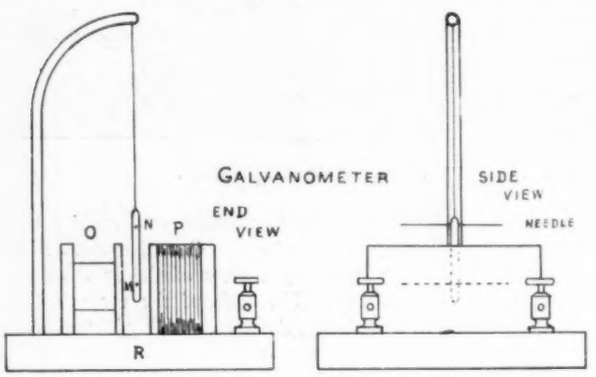
Easy Electrical Experiments
FOR BOYS

By L. P. Dickinson

[Note: The following chapter on Resistance is a continuation of Chapter XXVIII which appeared July 26, and concludes the work on the instruments commenced at that time. Illness of the author prevented earlier publication.—Editor P. M.]

CHAP. XXXI.—THE MEASUREMENT OF RESISTANCE.

In the last chapter we constructed a piece of apparatus for the measurement of resistance. This apparatus is, however, dependent for its action upon some form of sensitive galvanometer capable of responding to a very weak current. Such an instrument will now be described. A side view and a front view is given in the accompanying figure. R is a block of wood,



3 inches square and ½ inch thick. On this block is to be mounted two coils, shown at O and P. One of these, P, is shown complete while the other, O, is shown without the wire in place. To make the forms for these coils, take a block of wood, 1½ inches long and ½ inch square in cross section. Next make two pieces of wood, 2 inches long and 1 inch wide, one of the pieces being ¼ inch thick, the other ⅛ inch thick. Glue these to opposite sides of the block just mentioned in such a manner that the block will be at the center of the pieces. One or two small brads will help to hold them in place. This will make a small form, of which the block forms the core, and the two larger pieces the sides. Make two such forms. They are to be wound full of No. 32 double silk covered magnet wire, of which about 3 ounces will be required. They are then to be mounted, as shown in the figure, at equal distances each side of the center of the 3-inch block, the thinner flanges of the coil being turned towards the center. The distance between the coils is ⅜ inch.

Take a very small piece of soft wood, 1 inch long and about ⅛ inch in diameter. A piece of a match will answer. Push through it two small sewing needles, the distance between the needles being ⅝ inch. If the needles split the wood, push them through a longer piece first, and then cut the piece down to the right length.

These needles are to be magnetized by stroking them with a magnet. But the greatest care is necessary in the process. The magnets must be magnetized so that the north pole of one is directly above the south pole of the other. To accomplish this, stroke the end of one needle several times with the pole of a strong horseshoe magnet, and then immediately stroke the end of the needle which is directly below the first with the other pole of the magnet. Magnetized in this way, there is little tendency for the pair of needles to point north and south, as in the case of ordinary magnetic needles.

Near one edge of the baseboard, bore a hole ⅛ inch in diameter, and fit into this hole the end of a piece of brass rod bent into the shape shown. The height of the top of this rod when bent over should be about 3½ inches above the baseboard, although the exact height is not important.

Support the needles just constructed by a very fine silk fibre, made by untwisting a very small fibre from a bit of silk thread. The finer this fibre is, the better. It can be fastened to the needles, and also to the brass rod by means of a bit of sealing wax. The lower needle should hang at the center of the space between the two coils.

Connect the two coils together so that the current will go around them in the same direction. Connect their free ends to two binding posts as shown.

Now we are ready to make use of the instrument in the measurement of resistances. Referring now to Fig. 1, in the preceding paper, the galvanometer is connected to the wires indicated. It is then turned so that the freely suspended magnetic needles hang in the space between the coils and parallel to the coils. If it is difficult to find such a position, a small piece of iron, or a magnet, placed near the instrument, will bring the needles into the desired position.

At S, in Fig. 1, is shown a standard coil. This is made by coiling on a spool about 39½ ft. of No. 24 copper wire. The resistance of such a piece of wire is almost exactly one ohm. It will do nicely as a standard. At X, in the same figure, connect any coil whose resistance we wish to determine. If now the key K be pressed, and its position shifted back and forth, there will finally be found a point where there is no deflection of the galvanometer. At first the deflection will probably be quite violent, but by beginning at one end of the stretched wire, and working towards the other end, a point will finally be reached where pressing the key will not affect the galvanometer needle at all. When this point is found note its position on the yard stick.

Then, to find the resistance of X, multiply the length of wire to the right of K by the value of S (in this case one ohm), and divide by the length of wire to the left of K.

In case high resistances are being measured, a high resistance coil must be used at S in place of the one ohm coil just described. Having this one ohm coil to start with, the amateur can easily make for himself other coils of 5 or 10 ohms each, and from these still higher ones. In any case the measurement is the easiest made, when the resistances at S and X are the most nearly equal.

As an example, take the following. Suppose a 10 ohm coil be inserted at S, and that with an unknown coil at X, a point is found at 11 inches from the left hand end of the wire, where there is no deflection. Then the resistance of the unknown coil is found by multiplying the length to the right of K (25 inches in this case) by 10, and dividing by 11. The result would be, in this case, 22 7-10 ohms. In order to apply this rule, however, the coils must always have the position shown, that is, S must be on the left-hand side of the apparatus.

QUESTIONS ANSWERED.

"I would like to know how and where the carbon blocks are attached on the telephone transmitter described in Chap. 24. Also, what length of spark on a Weimshurt machine is needed to make an X-ray strong enough to see through my hand? What does a tube cost?"

Answer.—One carbon block is attached to the back of the diaphragm at its center, by a screw passing through the diaphragm and into the carbon. The other carbon is attached in a similar manner to the center of the wooden strip at the back. A piece of wood driven cross-wise through the carbon, as described, holds the screw firmly.

A 4-inch spark is necessary to produce the X-rays. Use an ordinary X-ray tube, such as may be purchased at a minimum price of $7.50.

SEES VICTORY FOR AMERICAN COAL.

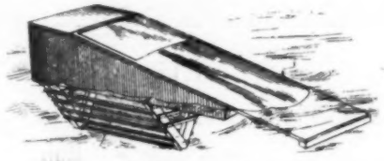
American coal cannot long be kept from Mediterranean ports, according to the confessions of the British consul at Marseilles. He reports: "An interesting feature of the last year has been the inability of American coal to stay on the market. The threatened invasion, however, has only been postponed.

"The temporary check has been caused by the fall in prices. Any rise in prices will inevitably bring American coal back to the Mediterranean, even under the existing American conditions. The 200,000 tons placed here with the railway and shipping companies and the gas works gave full satisfaction so far as quality went and the old prejudice against it is beginning to disappear. The difference in the 'firing' value of British and American competing qualities, which has heretofore been estimated at 10 per cent against the latter, has already been reduced to 7 per cent.

"The time must inevitably come when the activity of the American coal mining industry will place a large output on the market. When the Americans have got their own shipping and through bills of lading from the pit's mouth to the Mediterranean they will bring their coals to the great Mediterranean ports, if not further, at the expense of the British."

TRAP TO CATCH TURTLES.

In southern waters, where the turtles grow large and command a good price in the market, the catching of turtles is quite an industry. Elam J. Rusk, of Kleinwood, La., has just patented an automatic trap. He has taken advantage of the well-known habit of the turtle to climb on an old log or floating snag to sleep in the sun. His



Turtle Trap.

trap is anchored in a place where turtles congregate, and floats. The turtles, in climbing to the highest point, step on a trap door, which drops him into a crate and then springs back ready for more.

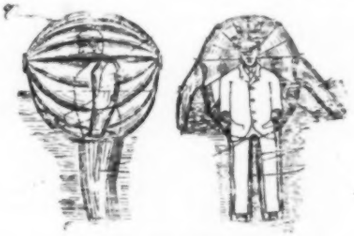
AMERICANS THE GREATEST INVENTORS.

The American people, with the exception of the French, are the greatest inventors in the world. At the present rate America will soon be ahead of France. The great number of patents that are now being taken out would lead many, when they stop to think of it, to believe that the market would soon be swamped and that every possible improvement or conception would be covered; in other words, that there would soon be nothing more left to invent. But the same thing was thought by people a few years ago, when a great majority of the late inventions now in use were unknown.

The Age of Steel says: Covering so simple a thing as a wood-screw, there are over 200 different patents; in the class of lanterns over 1,500 patents, and for wash boilers about 500 patents. For tobacco pipes and mouth-pieces, over 600 patents have been issued, and for bottle-stoppers about two thousand. These are among the simplest devices, but coming to the more important classes, there have been thousands of patents issued for sewing machines and their various attachments; for firearms, not including heavy ordnance, torpedo or machine guns, the number also mounts up into the thousands, which can also be said of car-couplings, as well as of knitting and weaving machines. For agricultural implements, including planters, harvesters and threshers, and the whole range of machines and implements, the total number of patents is about 40,000, of which over 7,000 relate to plows alone.

LIFE PRESERVER.

This new life preserver is the idea of



Ready for a Voyage.

Geo. B. Conley, Cleveland, and consists of a strong waterproof covering held in shape by a framework. Glass windows admit light. There are arms and legs. When not in use it can be folded up.

NOVEL METHOD OF WASHING ASPHALT STREETS.

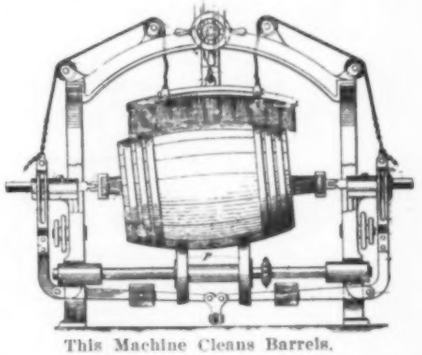
Geneva, N. Y., has laid many streets with asphalt and the city engineer has devised a cheap and rapid method of street

Traveling Street Flusher, Geneva, N. Y.

cleaning. A long section of fire hose is attached to a hydrant. The other end is connected to a piece of iron pipe perforated with holes, reaching from curb to curb. A team is hitched to the pipe and travel slowly along the street, the water pouring from the pipe. Small two-wheeled trucks are placed under the hose at short intervals to facilitate its being drawn. In this way a block is cleaned in a few minutes.

BARREL CLEANING MACHINE.

In many industries requiring barrels the same barrels are used over again. To clean them for second use a machine has

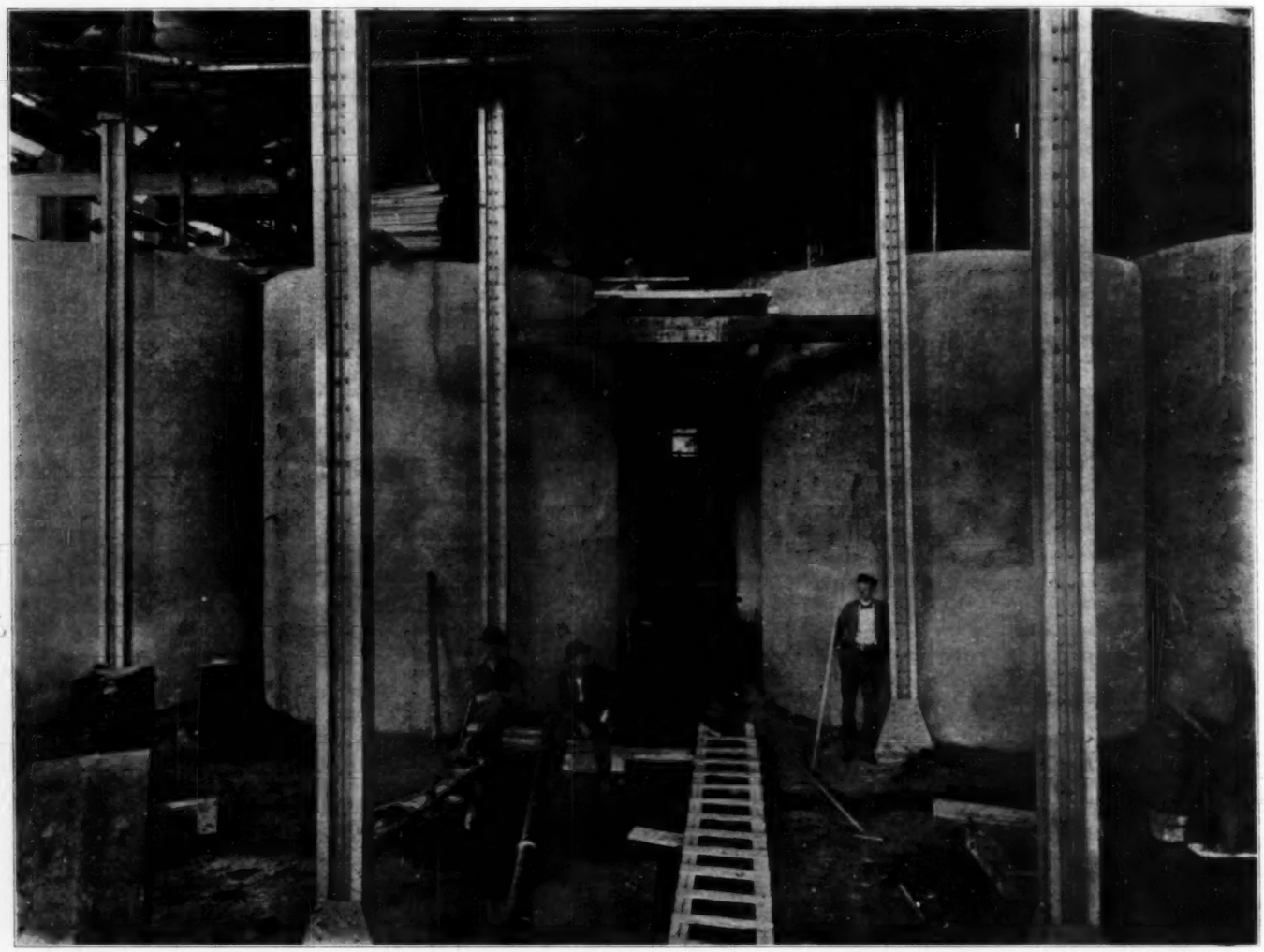


This Machine Cleans Barrels.

been built by Gustav Schock, of New York. The barrel is revolved rapidly under a strong, heavy brush, while resting on two wheels, and is given an oscillating motion which presents every part of the barrel to the brush.

CONCRETE TANKS FOR PAPER MILL.

Our illustration shows a few of the 28 tanks built in a large paper mill at Rumford Falls, Me. These tanks are constructed of cement laid on expanded metal, the manufacture of which



Concrete Tanks in Paper Mills, Rumford Falls, Me.

was recently described in these columns. The tanks are 20 feet high and 14 feet in diameter and are used in the bleaching department of the mill where the chemicals would quickly destroy a steel tank. This construction is very strong, is impervious to the action of water or chemicals and is expected to last for 100 years.

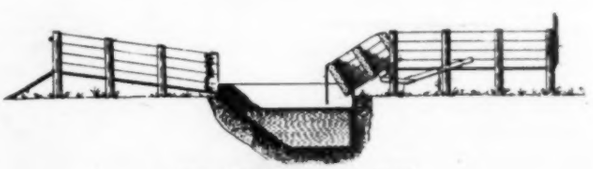
DEVICE THAT PROTECTS RAILROADS FROM AVALANCHES.

The Caledonian Railway of Scotland winds through the mountains of the famous Grampian range, and abounds in steep grades and sharp curves. At one point the line is built on a narrow ledge, cut out of the mountain side, while hundreds of feet below in sheer descent is Pass of Brander. The mountain side above is covered with immense boulders, which are loosened during storms, and roll down upon the track, making operation of the trains extremely dangerous. The Railway Age explains a recent device to make travel safe.

A set of 13 signals are placed along the track with arms which are held in position by a set of wires forming a network or fence. When a stone rolls down upon the track it breaks through these wires, releasing weights which instantly raise the signal arms, giving the danger signal. At the same instant an electric alarm is sounded at the nearest station and the operator there sends men to clear the track, and also notifies all trains.

ANIMAL DIPPING APPARATUS.

To dip sheep and other stock a machine has been constructed by W. H. Tuck, of Sinclair, Neb. A reservoir is prepared, into which the dipping fluid is poured, and the animals driven

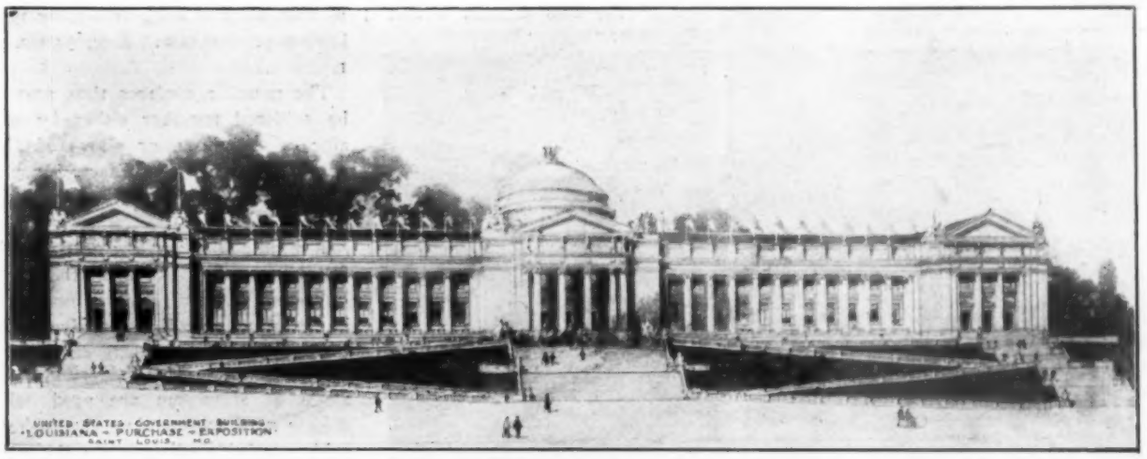


The Sheep Do the Work.

into it, one at a time. A tilting floor, worked by a lever, tumbles the animal into the tank. It then climbs out on the incline, which leads away, and on which the animal stands long enough to drain, the dipping fluid running back into the tank.

BUILDING OF SPLENDID STAIRS AND STATUES.

Entered by a great flight of stairs 100 feet wide, adorned with statues and surmounted by a dome 93 feet in diameter—modeled after the dome of the Pantheon at Rome—the United States government



Uncle Sam's Home at the St. Louis Exposition.

building at the World's Fair is to be one of the most imposing structures in appearance ever constructed. The structure was designed by James Knox Taylor, supervising architect of the treasury department. In the center of the great flight of stairs leading to the building will be a platform 45 feet by 125 feet, with an exedra on either side. Two smaller flights of stairs, 50 feet wide, also adorned with statues will give entrance to the end pavilion. The main facade of the building will be 764 feet long, with a center and end pavilions connected with a colonade of Ionic columns, 5 feet in diameter and 45 feet high.

TINY ELECTRIC PORTABLE COOKING STOVE.

A tiny electric stove that a person, when traveling, may pack in his or her grip and attach to any electric light socket, has recently been placed on the market. With its services hot water may be had in one's own room when wanted for tea, coffee, shaving, sickness, etc.; one may boil eggs, make toast, or beef tea, warm rolls, cook cereals and, in fact, prepare almost a full meal. The stove consists of a tiny heater and a cup. The latter has a recess in the bottom which encloses the heater, completely hiding it so that a person, in seeing the cup, would never dream of the presence of a stove underneath. The cup holds 1½ pints, is heavily tinned inside and of polished nickel outside. All parts of the apparatus pack within the cup, which is 3¼ by 5 inches in size and weighs complete 2½ pounds.

Portable Electric Stove.

MACHINES TOO FAST FOR THE MAN.

"In such a test as will be necessary to try the automobile of the future to its limit there will be more failures among men than machines." So declares the Motor Age in the same vane that Popular Mechanics a short time ago said that it would not be difficult to build a steam engine that could pull a train at the rate of 100 miles an hour, but it would be extremely difficult to find an engineer to drive such an engine and keep from becoming a nervous wreck in a very short time. The Motor Age continues:

"The time is coming when, if contests are to continue, the machine will have outlasted the man and more than one operator will be necessary to give the machine the test it is capable of withstanding."

ALCOHOL FIRE ENGINE.

The chief of the fire department at Hanover, Germany, has built an auto fire engine which uses alcohol for fuel, both in running to the fire and in pumping afterward. It is the first auto fire engine in Germany. Another will be built at once.

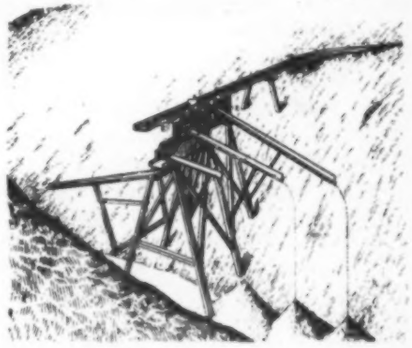
The campanille of St. Mark's Cathedral, Venice, which collapsed July 14, was 320 feet high and had stood for 1,000 years.

FEW EGGS BEING PLACED IN STORAGE.

Handsome profits were realized from storage eggs which went in last year at the highest price on record. Notwithstanding this fact, fewer eggs are being placed in the coolers this year in the large centers than last year. In Boston there are 183,000 cases in storage against 217,000 this time last year; in Chicago there are 550,000 cases against 650,000 this time last year; in New York the total receipts are much greater than last year but the number in storage considerably less.

METHOD OF BUILDING DAMS.

To build dams by the use of hydraulic power, Arthur D. Foote, of Grass Valley, Cal., proposes to pump the material for the dam to the point where required for use, and there separate it through screens,



Building Dams by Gravity.

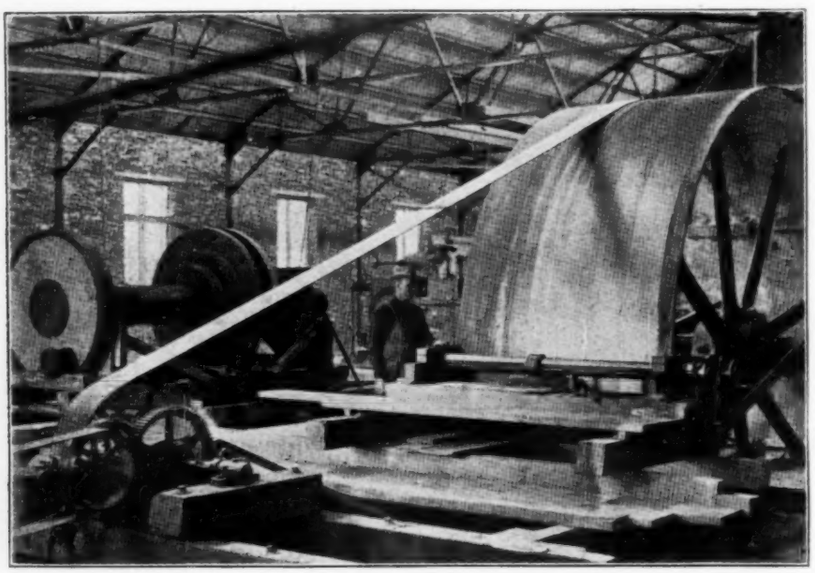
discharging through three spouts. The coarsest material being deposited on the down stream side to give support and the finest on the up stream side of the dam to fill spaces and retain the water.

"No use to gib me castr ile, Doctur," she said, "hit don't 'fect me ther one way ner tother."

SHOP NOTES

FACING OFF A LARGE WHEEL.

In moving all or part of the machinery in a plant, much is often scrapped which might easily have been adapted to new conditions and thousands of dollars saved.



Facing off a Large Wheel.

The Practical Engineer for August tells how a pair of wheels were saved. One was 37½ inch face and 15 feet diameter; the other 37½ face by 15 feet ⅜ inch diameter,—a difference of ⅜ of an inch.

To use them in the new plant they must be exactly alike. The first work was to get the wheels placed upon the shaft and securely fastened; this was done by the use of four plates, 9 feet by 3 inches by 1 inch, having two 1¼ inch holes drilled 6 inches apart; bolts made to fit were securely screwed through these to the rim of the wheel, thus insuring their rigidity. This done, the arrangement for turning off the face of the wheels was made; a few, 10 by 10, timbers were bolted together in crib form, and across the top of this was placed an ordinary boring bar which was securely adjusted in two hard wood boxes, at a perfect square with the engine shaft, and then properly leveled. The feed-gear was then attached to one end of the bar, with the feed motor taken from the eccentric of the engine, thus securing an automatic feed.

At a distance of 200 feet back from the bar a triplet of gears and a 36 inch pulley was rigged; from this pulley was run a 10 inch belt around the wheels to be faced off. Power was supplied to the triplet gearing from a 4 inch belt run back to a five horse-power engine.

After this arrangement was perfected nothing remained to do but set the tool and start the wheel revolving, which was done at the rate of 42 feet per minute.

After the ⅜ inch was taken off the larger wheel, a cut was taken across the whole face of the two wheels, 6 feet 3 inch. After finishing that cut, the taper on crown was then easily turned. The surface was left for a distance of 18 inches in the center perfectly flat; from that point the crowning was carried to the edges, thus completing the job and making the wheels answer the purpose in a manner equal to a new one at a cost not very much in excess of the freight rates and cartage of a new one.

1,200 H. P. GAS ENGINE.

A 1,200 horse-power gas engine has been built in Belgium. It has two explosion cylinders each 51 inches in diameter and 55-inch stroke, and makes 80 revolutions per minute. It furnishes 20,000 cubic feet of air per minute by tandem connection to a blowing cylinder.

SOLDERING ALUMINUM.

A perfect solder for aluminum is yet to be found. An apparently well soldered joint will frequently corrode after a few months' exposure to the atmosphere. The American Blacksmith gives the following directions:

Small surfaces of the metal can be soldered by the use of zinc and Venetian turpentine. Place the solder upon the metal together with the turpentine and heat very gently with a blow-pipe until the solder is entirely melted. The trouble with this as with other solders is, that it will not flow gently on the metal. Therefore large surfaces cannot be easily soldered.

J. S. Sellon patents the following method: Clean the aluminum surfaces by scraping, and then cover with a layer of paraffine wax as a flux. Then coat the surfaces by fusion, with a layer of an alloy of zinc, tin and lead, preferably in the following proportions: Zinc, 5; tin, 2; lead, 1.

The metallic surfaces thus prepared can be soldered together either by means of zinc or cadmium, or alloys of aluminum with these metals. In fact, any good soldering preparation will answer the purpose.

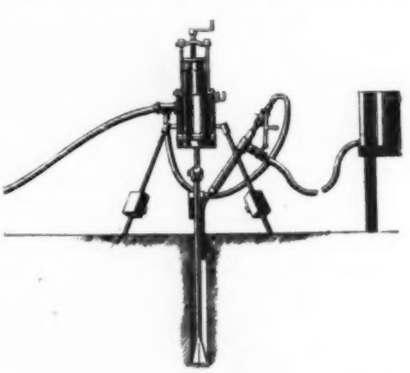
A good solder for low grade work is the following: Tin, 95; bismuth, 5.

A good flux in all cases is either stearin, vaseline, paraffine, copaiva balsam, or benzine.

In the operation of soldering, small tools made of aluminum are used, which facilitate at the same time the fusion of the solder and its adhesion to the previously prepared surfaces. Tools made of copper or brass must be strictly avoided as they would form colored alloys with the aluminum and the solder.

WATER ATTACHMENT FOR POWER DRILLS.

Our illustration shows the type of rock drill in common use, being driven either by steam or compressed air, which comes through the hose shown at the left. F. L.



Whitehead, of Butte, Montana, has devised an improvement by which water is injected into the drill hole to wash it out, the injector using the same source of power as the drill.

WANTS TOOLS FOR DRESSING VALVE SEATS

Popular Mechanics: Will you kindly inform me where I can get a set of tools for dressing up valve seats. I want a tool that I can use in place of grinding a valve.

Frank R. Stall.

P. O. Box 326, Juneau, Alaska.

SIMPLE METHOD OF LINING AN ENGINE.

In the August number of Power,—which by the way is an unusually interesting issue,— W. E. Crane gives a simple method of ascertaining to what extent, if any, an engine has gotten out of line. Mr. Crane says: Take out all the reciprocating parts and put a line through the cylinder reaching to front of the crank. This line should be a fine, braided line, preferably of silk.

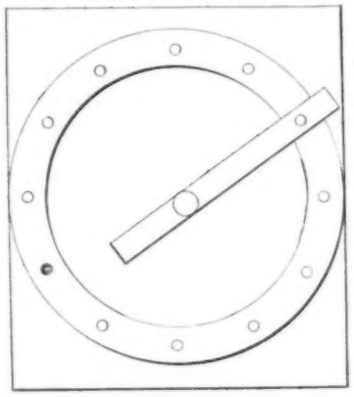


FIG. 1.

It can be fastened and centered in the back end of the cylinder with a stick bolted with one bolt, as in Fig. 1, or can reach across and be fastened with two, as in Fig. 2. In front of the crank set a stake that can be adjusted sideways, as shown in front and side views in Figs. 3 and 4. Put the line as near central of the cylinder as possible and draw it tight so that there shall be no sag. Commence at the back end of the cylinder and center the line.

The best thing to use for caliper is a pine

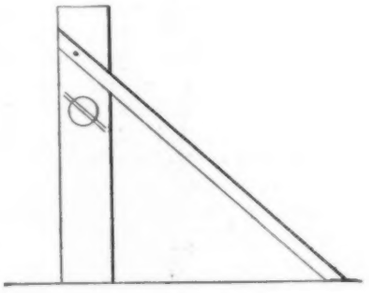


FIG. 3.

stick nearly sharp at one end and a pin in the other that can be drawn out or pushed in for adjustment. Have one for the end of the cylinder and one for the stuffing-box, moving the line at its support at the stake in front of the crank. When central here, try the back end of the cylinder and so alternate until the line is central at both points. It is then in line with the cylinder and all other parts should be in line with it. Try the guides. One builder had most of the engines that he built and erected crooked at the point *A*, Fig. 5, and

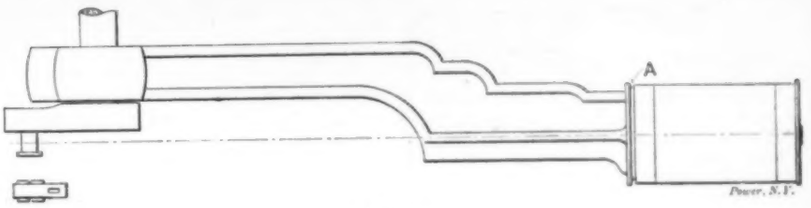


FIG. 5

shims were required to throw the cylinder around into line with the guides.

Bring the crank-pin down to the line, or if the crank is down, which is the better positon, bring it up to the line and see if the line is central to the pin. Turn the crank around to the other center. If the line is central at both points, it is all right; if the line comes one side of the center on one side and on the other side on the other, the outside journal wants swinging around, if a single engine; if double, one of the cyl-

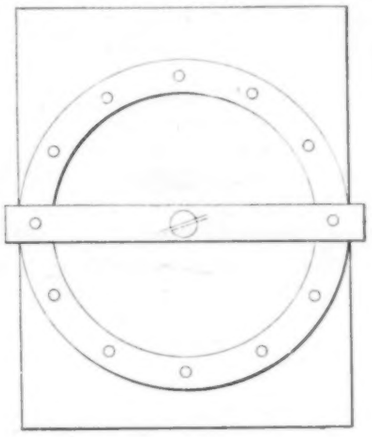


FIG. 2.

inders may have to be moved. If the line comes to the same side of the center of the pin when the crank is in both positions, then the shaft is not set right.

The cheapest and quickest way to overcome this is to take off the required amount of metal from the crank-pin boxes and sweat, or solder an equal amount on the other side.

A temporary alignment can be made without taking the engine apart by putting the engine on the back center and putting

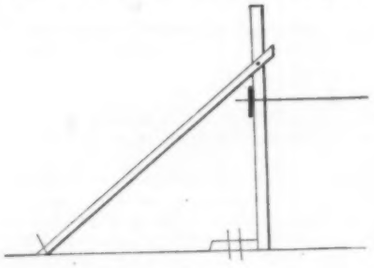


FIG. 4.

a line alongside the engine parallel with the piston rod and then measuring off to the crank-pin from that line.

Be sure the pulley (which may be perfectly true) is put on the shaft true.

COLORLESS VARNISH.

Colorless varnish for use on fine labels or other prints, as well as for white wood and other spotless articles, is made as follows: Dissolve two and one-half ounces of bleached shellac in one pint of rectified alcohol; to this add five ounces of animal boneblack, which should first be heated, and then boil the mixture for about five minutes, filter a small quantity of this through filtering paper and if not fully colorless add more boneblack and boil again. When this has been done, run the mixture through silk and through filtering paper. When cool, it is ready for use. It should be applied with care and uniformity.

LIGHTNING'S STRANGE PRANK AT FORT LEAVENWORTH.

An account of a remarkable lightning phenomenon at Fort Leavenworth, Kan., is furnished by Peter C. Strass, of Leavenworth. During the heaviest rain of the year there the skies were rent by a great streak of lightning that seemed to flash across the heavens and shoot forks of flame down on the Fort. It set fire to the cavalry stables, and on examination it was found that it had broken the wires on every bale of hay in the mammoth hay loft. Of the thousands of bales there stored not one escaped being completely untied by the mysterious occurrence. Scientists and electricians in Leavenworth and Kansas City are now busy trying to explain the perplexity, but so far they remain in bewilderment.

The Krupps refuse to exhibit at the St. Louis world's fair because the United States refused to purchase the big gun exhibited at the World's Fair in Chicago. This gun, which was built especially for the exposition, is now out of date and in the way.

ONE MAN WANTED

IN EVERY SHOP
IN THE UNITED STATES
AT GOOD PAY
TO REPRESENT

POPULAR MECHANICS

WRITE US

SECOND HAND
DYNAMOS AND MOTORS

We carry a large stock of high grade second hand dynamos and motors for all purposes, and fully guarantee every machine we sell. We are equipped to promptly rewind any make of machine, and solicit your correspondence if you wish to buy or sell.

Guarantee Electric Company
133 to 139 S. Clinton St.
CHICAGO
CHAS. E. GREGORY, President

ELECTRICAL BARGAINS

Complete N. D. outfit for Learning Telegraphy $1.75
Pocket Electrical Search Light..... 1.50
Complete Electric Bell Outfit..... .85
2 Complete Electric Telephones, good for lines up to 2,000 feet..... 7.00
Handsome D. T. Medical Battery, with guide for treating 100 diseases..... 3.50
Any of the above sent by express (not prepaid) on receipt of price.

Universal Dating Stamp, by mail, prepaid, for 25 cents.

J. H. BUNNELL & CO.
Inc.
Established 1879
20 Park Place, New York
N. B.—Send for catalogues, Dept. M.

What Is Schapirograph?

The Duplicator that cleanly multicopies anything written by pen and typewriter. One original gives 150 copies Black ink in 15 minutes. Avoids: stencil, washing, delays, and expensive supplies. Price, complete cap-size outfit, $8.00. Lasts years.
PRACTICAL TRIAL without DEPOSIT cheerfully allowed by
The Popular Schapiro-Graph Co. 265 Broadway, N.Y.

No Progressive Merchant, Manufacturer, or Organization can afford to be without The Elliott Addressing Machine for addressing Envelopes, Cards, Wrappers, Statements, Shippings Tags, Circulars and Time Cards Our Catalogue explains fully.
SEND FOR CATALOGUE "F."
THE ELLIOTT ADDRESSING MACHINE CO.
48 Dearborn St., Chicago

Mention Popular Mechanics

HOW THE TERM "PRINTERS DEVIL" STARTED.

It used to be in the ancient days of Italy that printing was much of a mystery and people thought the printer evoked the aid of the evil power. There was a certain Italian printer, living in the 15th century, who went to Africa on an exploring expedition and brought back with him a little pickaniny, who was very black. Negroes were a rarity then. The report immediately gained circulation that the printer had been employing the Black Art in his work and that the little negro was in reality an imp of pergatory. He was called the "Little Black Devil." The charge became so serious that the printer was forced to publicly exhibit the negro. In so doing he said:

"Be it known to Venice that I, Aldus Manutius, printer to the Holy Church and to the Doge, have this day made public exposure of the Printer's Devil. All those who think he is not flesh and blood may come and pinch him."

And that is how the term "printer's devil" had its origin.

TWO AMERICAN DRUMMERS IN CHINA.

Their Success Is Proof of the Splendid Field In the Orient for Young Men and Manufacturers.

Two young Americans, who acquired a sufficient knowledge of the Chinese language in San Francisco, to enable them to tour China as commercial salesmen, have just returned from their first trip and their success was so gratifying as to lead to the belief that here is a magnificent opening for young salesmen, as well as American manufacturers. The men took with them samples of watches, rings, lockets, collar and cuff buttons, watch chains, electrical supplies, clocks, cotton piece goods, etc. They found the Swiss watches and French make of watches already in the field, but they succeeded in making large sales at prices higher than their competitors. There was a good demand for American plated jewelry. In clocks, it was impossible for the Americans to compete with the Japanese, who sold clocks of as good quality at half the cost. Europeans also greatly undersold the Americans in all grades of cotton goods. In speaking of their work Consul General W. A. Rule, of Hongkong, says:

"The experience of these two young Americans affords good evidence that there is much commerce to be secured by Americans if it is properly sought. These young men had acquired a sufficient knowledge of the language to make themselves understood. They had, therefore, the great advantage of being able to do business directly with their Chinese customers. As it was their first trip to the Orient, they did not bring a large variety of samples, but the results have been so encouraging that they propose to return equipped with an enlarged outfit. The method pursued by these young men is worthy the attention of our manufacturers. If two young Americans can learn the language in San Francisco sufficiently to enable them to deal with the Chinese in their own country, others can do the same."

THE MINIMUM GRADIENT FOR A SEWER.

In laying a sewer pipe there should always be a grade which will give a self-cleaning velocity. This will depend upon the character of the sewage. For 15-inch sewer, if two feet a second is assumed as the self-cleansing velocity, the minimum gradient, according to Latham's tables would be 0.133 or 1.6 inches per 100 feet. Municipal Engineering says: By Kutter's formula, the velocity of flow in a sewer on this gradient would be slightly over 1¼ feet a second. These velocities are computed for sewer running full or half full. If the usual flow of sewage is very small, and flushing flows are infrequent, the gradient should be increased as the volume of constant flow is reduced. Many sewers have been laid on less gradients than the minima here stated, but always with the expectation of later expense for cleaning.

Bicycles are now becoming popular in Japan, but are used for practical not pleasure purposes. There are 13 automobiles in Japan.

The great demand for iron at present in this country, has enabled German works to ship large quantities of iron and steel here to be used in manufacturing.

A Swedish physician who has made a study of the subject, finds that the chewing of Burgundy pitch, which is common in some sections of that country, has a marked effect in preserving the teeth.

To Whom It May Concern:

I have opened an office at Rooms 1520-21 Marquette Bldg., 204 Dearborn St., Chicago, for securing Patents, Trade-marks and Copyrights in the United States and Foreign countries.

Having been actively engaged in practice before the Patent Office at Washington, D. C., and the United States Courts since 1881, during which time I have conducted nearly one thousand patent cases, I feel qualified to offer my services to those who are interested in patents as inventors, investors and manufacturers. My office in Washington will be retained in charge of a competent associate, so that clients will have the advantage of direct representation at the Patent Office as well as of personal consultation with their attorney. After patents are obtained, I will assist clients in disposing of their patent rights to the best advantage.

Books on Patents, and references will be furnished upon request

Respectfully,
FREDERICK BENJAMIN,
PATENT ATTORNEY AND SOLICITOR.

Telephone, Cent. 520.

CRAB FISHING IS GOOD PAY BUT POOR SPORT.

Sitting in a boat with a sqirming, clawing, grimy, fighting mass of crustacea beneath you and the sun beaming down with torrid heat, is not one of the most enjoyable or sportsman-like occupations in the world, but it is remunerative to the man in charge of the fishery. Such is the life of the crab fishermen, who, on the southern coast, are for the most part negroes. It is from the negro that the "trot" line, by which the crabs are generally caught, derived its name. The "trot" line is a rope, maybe 500 feet long, staked out in the water, which is usually shallow. To this line are attached strings, to the end of which is a piece of meat. The strings are so arranged that the meat just about touches the bottom. The staler the meat the better it pleases the crab's taste.

Starting from one end in a boat with a dip net the crabman navigates the crabbing ground, pulling himself along by the line and raising the strings gently to the surface. There are often half a dozen pairs of claws holding on to each piece of bait and the crabman has only to poke his dip net under them and tumble them into his boat. The boat fills rapidly and one or two trips over the line often begets a full load. By the time the crab catcher has finished fishing the line one way he starts back over it again, with no interruptions except to carry his loads to the packing house. The crab meat sells at from 80 cents to $1.50 a gallon.

GETS HOTTER EVERY WEEK.

Popular Mechanics (Journal Bldg., Chicago), the new weekly illustrated review of the mechanical press of the world, is "going ahead like a house on fire."—American Shipbuilder.

SUSAN SIMPSON.

Sudden swallows swiftly skimming,
Sunset's slowly spreading shade.
Silvery songster's sweetly singing,
Summer's soothing serenade.

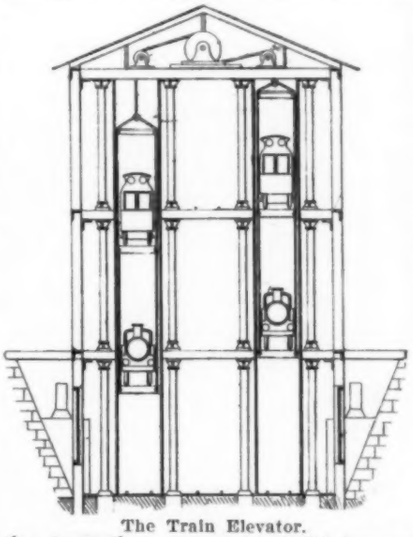
Susan Simpson strolled sedately,
Sifting sobs, suppressing sighs;
Seeing Stephen Slocum, stately
Stopped she, showing some surprise.

"Say," said Stephen, "sweetest sigher;
Say shall Stephen spouseless stay?"
Susan, seeming somewhat shyer,
Showed submissiveness straightway.

Summer's season slowly stretches,
Susan Simpson Slocum she—
So she signed some simple sketches—
Soul sought soul successfully.
—From "The Pernin Stenographer."

SCHEME TO ELEVATE TRAINS.

This invention is a curiosity. It seemed so big to the inventors that two of them were necessary to think it out. To load passengers or freight at different floors of



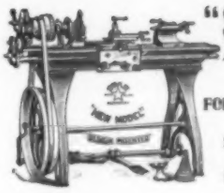
The Train Elevator.

the depot they propose to build immense elevators which will raise and lower whole trains, weighing hundreds of tons, at a time. The same object might have been accomplished by placing the trains on the ground, and elevating and lowering the depot!

Are You Interested in
Automobiles?
Send for Sample Copy of
THE AUTOMOBILE REVIEW, $1.00 a Year
The Automobile Review
19 Quincy St., Chicago

The First Step to Success

is technical training. For ten years we have been training ambitious people to succeed. Write for circular, showing how we give you the training BY MAIL required by a Mechanical, Steam, Electrical, or Civil Engineer; Draftsman; Architect; Ornamental Designer; Chemist; Bookkeeper, etc. Mention position that interests you.
International Correspondence Schools, Box 812 Scranton, Pa.



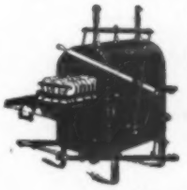
"Star" Foot and Power Screw Cutting Automatic Cross Feed **Lathes**
FOR FINE, ACCURATE WORK
Send for Catalogue B.
SENECA FALLS MFG. CO
102 Water Street,
Seneca Falls, N.Y., U.S.A.

PATENTS
CAVEATS, TRADE-MARKS, COPYRIGHTS AND DESIGNS
Send Your Business Direct to Washington
Saves Time and Insures Better Service
PERSONAL ATTENTION GUARANTEED
21 YEARS' ACTIVE PRACTICE
SPECIALTY
Interference Contests and Validity Reports
Address
SIGGERS & SIGGERS
PATENT LAWYERS
Suite 20, N. U. Bldg., - Washington, D. C.

ORLAN CLYDE CULLEN,
Counsellor-at-Law
U. S. Supreme Court, Registered Attorney U. S. Patent Office, United States and Foreign Patents, Caveats, Trade Marks and Copyrights.
No. 700 7th Street, N.W.
Opp. U.S. Patent Office. WASHINGTON, D. C.
Mention Popular Mechanics

Send for Free Sample Copy of
INVENTIONS
The Representative Mechanical Monthly of the Pacific Coast.
Only 50 Cents per Year. Low Advertising Rates.
R. WILLIAMSON & CO., Publishers,
Mills' Building, San Francisco.
Mention Popular Mechanics

NO MORE DISHWASHING



By hand. Only practical washer ever made. The great home, hotel and restaurant labor-saver. Send for full description.
THE GARIS-COCHRANE DISH WASHING MCH. CO.
325 Dearborn St., Chicago
Mention Popular Mechanics.

New Publications for Engineers

High-Speed Steam Engines

A Guide to English and Foreign Practice. By W. NORRIS, M. I. Mech. E., &c. and BEN. H. MORGAN. With Reproductions of over 13 Photographs and Drawings, and Numerous Tests. Second Edition. Demy 8vo, cloth. $2.80, mailed free.
"We can cordially recommend this book to anyone who wants to know all about high-speed engines."—ELECTRICITY.

Pumps: Their Construction and Management

Graphically illustrating the different classes of Pumps, pointing out the advantages and disadvantages of each class, and giving hints as to management. By PHILIP R. BJORLING. Cloth; $2.00, mailed free.
Mr. Philip R. Bjorling is one of the greatest authorities on Pumps."

Transport by Æerial Ropeways

A Complete Practical Treatise on the Leading Systems of Ropeways. Fully Illustrated and Described by the Designers of each System. Second Edition. Paper. 35c, mailed free.
"An elaborate production describing all the important aerial systems."—MINING WORLD.

The "Engineering Times"

A Review of Modern Engineering Practice. Contains signed Articles by the most eminent Engineers. Printed in magazine form, and elaborately Illustrated. Edited by BEN. H. MORGAN. 12 cents monthly; mailed free, 18 cents. Annual Subscription $2.25 free.
"The 'Times' of Engineering," VIDE PRESS.

London: P. S. KING & SON, 2 and 4 Great Smith Street, Westminster

"Want" and "For Sale" Ads. 10 cents per line payable in advance. Replies may be sent to a number, care Popular Mechanics, and will be forwarded promptly without extra charge.

BUSINESS CHANCES.

FOR SALE.—Steam laundry, fully equipped; modern machinery; located in thriving city of 3,000, in Central Iowa. For particulars address Mills Bros., Tama, Iowa.

FOR SALE—Design Patent No. 35,420, dated December 10, 1901. Design for ferrule. Address J. K. W. Carson, Winchester, Kansas.

TO HOTEL MEN—One of the finest openings upon the continent is offered to a good, experienced hotel man, with capital, in the Hotel Arcadia at Hermosillo, Mexico, a new building, just completed, with nearly 100 rooms; single guest chambers number 60; everything perfectly appointed and right to date. Will sell one-fifth interest. For further particulars address Capt. L. W. Mix, Nogales, Arizona.

A GOOD LAUNDRY FOR SALE—WELL equipped and doing $400.00 worth of business per week in an up-to-date Western city. Good reasons for selling. Apply to A. L. Gere, 437 Andrus Building, Minneapolis, Minn.

HOTEL FOR SALE.—In order to settle an estate we offer for sale a valuable hotel property situated in the heart of the White Mountain scenery of New Hampshire; location not excelled; large and lucrative patronage. For further particulars address Box 49, Bradford, Vt.

200 SHARES Gold Medal Mining Stock: pays good dividends. Price $3 per share; worth $6. I must have money and am willing to sacrifice. Address 432 Popular Mechanics.

HOTEL FOR SALE—The Damron House, Carmi, Ill. This house contains thirty (30) rooms, all furnished, and house in good repair; will be sold with furniture, fixtures and all complete ready for running. Will be sold for cash or easy payments. For further particulars call on or address Mrs. H. Damron, Carmi, Ill.

FOR RENT in Downers Grove, Ill., modern grocery store with fixtures complete, steam heat, new brick building, rent $25; liberal inducements to move; best location in town. Address V. Fredenhagen, Downers Grove, Ill.

LOCATED in best farming county in the state and for sale. A clean stock of hardware and groceries. Write for particulars to B. C. Smutz, Mendon, Mo.

POPULAR MECHANICS reaches the men who are searching for late inventions.

AUTOMOBILES—New and second hand, best bargains, 424 Popular Mechanics.

PATENTS OBTAINED—New book on patents free, 425 Popular Mechanics.

BUILDING plans, estimates, consultation and color sketches free—421 Popular Mechanics.

IF YOU WANT a machine, tool, or anything in a mechanical line and don't know where to get it, write Popular Mechanics.

FOR SALE.

FOR SALE—One 5 H. P. upright boiler and horizontal engine 3 x 6 in., almost new. Address, A. Hoelsche, Wheeling, W. Va.

FOR SALE.—Replaced with larger engine. Buckeye Automatic 9x14 in good condition. Bourbon Ele. & Milling Co., Bourbon, Ind.

FOR SALE.—New model Bicycle Motors, 1¼ h. p., $25. Accessories, $10. Can be attached to any ordinary bike of good strength. Horton Engine Works, Saginaw, E. S., Mich.

FOR SALE.—Bicycle Motors, 1½ h. p., Mofor Cycle frames. Stationary Gasoline Engines, 2½ h. p., $85; new. Twin City Bicycle Co., La Salle, Ill.

FOR SALE.—Steam Stanhope, $375; steam surrey, practically new, $775. Moriarty Co., Kansas City, Mo.

FIFTY Shirt Cambridge washer for sale. Good repair. Cheap. M. W. Fortune, Malone, N. Y.

FOR SALE—Set of second-hand tinner's tools cheap. Apply for list and price to G. T. Mueller, Columbus, Wis.

FOR SALE—One Style "A" Geneva Steam Runabout. Has run 1,100 miles; perfect in every respect; fitted with all the late attachments; cost $800; will take $485 cash, or trade for Winton or Haynes-Apperson tonneau. Write for full description. Robert Holmes, Danville, Ill.

FOR SALE—Winton in good order, 8½ h. p. A-1 motor, new Apple igniter, full leather top. Price $600. M. B. Flinn, 15 King St., Worcester, Mass.

FOR SALE at a low price—Bells, batteries, telephones, telegraph instruments, wire, zincs, sal ammoniac, motors, etc. Send for real bargains free. C. M. Turnquist, 442 W. Van Buren St., Chicago, Ill.

FOR SALE CHEAP.—Steam runabout, 414 Jackson st., Sioux City, Ia.

FOR SALE—5-acre tracts in the heart of Missouri's zinc, lead, fruit, nut and timber lands. $5.00 down secures a 5-acre tract. My circulars explain why these plantation lands will rapidly increase in value and how non-resident investors obtain a steady income from them. Address W. B. Sayler, Carthage, Mo.

FOR SALE—Patent No. 694,388, dated March 4, 1902. Bicycle and motor parasol and rain hood. Something needed by every bicycler. Can be applied to any machine. Address Robert Kaucher, 578 St. Paul Street, Rochester, N. Y.

FOR SALE—Planing mill, sash, blind and door factory. In good condition. Plenty of work. Steam and water power. In village of 2,000 population; has canal and railroad. For particulars inquire of C. F. Rice, Boonville, Oneida Co., N. Y.

HELP WANTED.

WANTED—Good tinner for in and outside work; steady work all year round for good man. State wages. Address Fred Thomas, Menomonee Falls, Wis.

WANTED—Young man to learn the green-house business, and the growing of roses and carnations; state age. Apply to John L. Wyland, DeHaven, Pa.

WANTED—Young man, handy with machinists' tools and understands general work. Address Box 567, Waterloo, Ind.

TRUNK AND SAMPLE CASEMAKER—C. H Forby, 1406 Douglas St., Omaha, Neb.

MECHANICAL DRAFTSMEN—Chief Draftsman, P. O. Box 911, Pittsburg, Pa.

WANTED AN AGENT in every town in the United States, Canada and Mexico, to represent Popular Mechanics.

PRESS HANDS WANTED for cutting tin. Missouri Can Co., 1210 W. 9th St., Kansas City, Mo.

POSITIONS WANTED.

POSITION WANTED—Young man of good education and ability, ambitious and not afraid of work, desires connection where he can learn civil engineering. Address 448 Popular Mechanics.

YOUNG MAN having experience with erection work and gasoline engines, desires position with automobile firm, preferably in erection and assembling or in drafting room; reliable, practical mechanic. Address 446, Popular Mechanics.

GAS AND ELECTRICAL ENGINEER of ability would like to go to Cuba or Philippine Islands. Very best credentials and experience. Address 422 Popular Mechanics.

YOUNG MEN who want to embark in business will find a valuable medium in Popular Mechanics Want Columns.

WANTED—Position to sell machinery. A man with 21 years' experience with machinery wants agency for machinery. Reference given if desired. Address R. M. Royal, Owenville, N. C.

SPANISH born gentleman, 32 years old, graduate of Technical American University, desires position as traveling agent through Latin countries. Acquainted with coffee and sugar machinery and perfect knowledge of Spanish. Address "Spanish" care of "Popular Mechanics".

SPECIAL.

AMERICAN and foreign patents—Caveats, mechanical drawings, designs. Klotz, Patent Attorney, 1303 Schiller Bldg., Chicago, Ill.

FOR SALE—Cheap, two hand-colored tempering charts explaining plain and scientific tempering in oil, water or tallow. Tells what each color will stand. Also 40 new steel working receipts, including machine and plow work, with 5 fine steel welding compound receipts, enabling you to weld all the different kinds of steel made. Also tells how to work self-hardening and the new imported French steel. All for one dollar. Send for samples free. W. M. Toy, Sidney, Ohio.

"Electrical Experiments"

We can supply back numbers containing the popular series

EASY EXPERIMENTS IN ELECTRICITY,

By Prof. Dickinson of the Electrical Department of the Armour Institute of Technology, Chicago, giving full and simple directions,

HOW TO MAKE

Simple Galvanometer	Jan. 18
Box to Hold Battery	Jan. 25
Tangent Galvanometer	Feb. 1
Powerful Magnet	Feb. 8
Induction Coil	Feb. 15
Simple Electric Motor	Feb. 22
Electric Circuit of Water	March 1
Voltmeter	March 8-15
Storage Battery	March 22
Simple Telephone	March 29
Electric Motor 1-20 H. P.	April 5-12-19-26-May 3-10
Set of Telegraphic Instruments	May 17-24-31-June 7
A Dry Cell Battery	June 14
Practical Telephone	June 21-28-July 5

Price 5 cents per copy, postpaid. Order of your newsdealer, or address Popular Mechanics, Journal Bldg., Chicago.

110,000 Art Pictures

For Sale at a

Great Bargain

These pictures comprise 11 subjects; 10x14 and 13x19 in. The finest 3-color work ever produced. Suitable for advertising and similar purposes. Printed on fine heavy paper. For sale in thousand lots at half price; all new, fresh and perfect. Address Art Pictures,

Popular Mechanics
Chicago

WANTED

A Representative in each city at Good Pay

POPULAR MECHANICS

Journal Building CHICAGO